# GAS-FUELED MULTI-MODE FIREPLACE ASSEMBLY

## CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to co-pending U.S. Provisional Application entitled, "Gas-Fueled Multi-Mode Fireplace Grate Assembly," having Serial No.: 60/419,397, filed October 18, 2002, which is entirely incorporated herein by reference.

## TECHNICAL FIELD

[0002] The present disclosure generally relates to a multi-mode gas-fueled assembly. More particularly, a modular gas-fueled assembly that in one embodiment operates as a gas starter for wood fuels. In an alternative embodiment, the modular gas-fueled assembly interfaces with a holder integrated with imitation wood to simulate a wood burning fire. In other embodiments, the modular gas-fueled assembly interfaces with other holders arranged for supporting imitation candles.

## BACKGROUND

[0003] Fireplaces are used not only to generate heat for warmth, but also for the pleasing light and ambience they produce. However, it is often too warm to necessitate use of the fireplace to generate heat, particularly in temperate climates. Furthermore, burning wood fuels for the resultant light, heat, and ambience is expensive, messy, and wasteful.

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[0004] To simulate the appearance of a wood-fueled fire, it is well known in the art to manufacture fireplace inserts that include artificial logs and a gas-fueled burner. The inserts typically include several logs of a concrete, ceramic, or other material designed to simulate the appearance of wood. A gas burner supplies a flammable gas in proximity with the logs. When the gas is ignited, the burning gas produces a flame that simulates a fire fueled by the imitation wood logs. The fireplace module can include a tank or other reservoir for storing the flammable gas. Alternatively, a supply line (*e.g.*, a pipe) coupled to a gas source can be connected to the burner to introduce the flammable gas to the burner. Fireplace modules that use artificial log assemblies provide heat and a pleasing simulated "wood-fueled" fire, while avoiding the inconvenience of loading and transporting wood into a home or other structure. Fireplace modules that use artificial log assemblies further avoid the general uncleanliness associated with splitting and storing wood, as well as removing ash and other waste products from conventional wood-burning fireplaces and flues.

[0005] Attempts have been made to use incandescent lighting to simulate flame. However, the resultant light often does not produce the flickering effect associated with a burning fuel. An alternative solution is to use inexpensive candles as a flickering light source by placing them inside the fireplace. Candles provide a fueled flame that produces a flickering light. In addition, candles do not generate enough heat energy to warm an adjacent room. Thus, candlelight can provide the light from a natural looking flame while not increasing the temperature of an adjacent room. However, problems result from introducing candles on the floor of a fireplace. First, the candles collect soot from the floor of the fireplace. Second, the candles produce light from the height of each respective candle flame above the floor of the fireplace when it may be desirable to direct light outward from the center or other locations within the fireplace opening.

[0006] A candleholder can be arranged to introduce one or more candles at various heights and locations within the fireplace. However, conventional candleholders must be removed from the fireplace, stored elsewhere, and replaced with a grate when wood is to be burned in the fireplace or a fireplace module when an artificial fire is desired.

[0007] Generally, grates have a plurality of legs that elevate the wood logs above the floor of the fireplace. The grate permits the wood to be burned safely and the

resultant ashes to fall through the grate for easy cleaning. However, placing candles on a standard fireplace grate is impractical, as there are no planar surfaces to support the candles in an upright orientation.

[0008] Accordingly, further improvements are desired.

## SUMMARY

[0009] In response to these and other shortcomings of the prior art, a modular multiple mode gas-fueled assembly is invented and disclosed. In one embodiment, the modular gas-fueled assembly operates as a gas starter for wood fuels.

[0010] In an alternative embodiment, the modular gas-fueled assembly interfaces with a first holder integrated with imitation wood to simulate a wood burning fire.

[0011] In other embodiments, the modular gas-fueled assembly interfaces with an alternative holder. The alternative holder includes hollow columns integrated with support plates for supporting imitation candles to simulate one or more candle flames.

[0012] One embodiment includes the alternative holder and a control circuit coupled to corresponding photosensors or heat sensors in proximity with each gas-fueled flame. The control circuit opens a valve to supply flammable gas to each of the imitation candles and/or the grate of the gas-fueled assembly. When arranged with a holder having one or more imitation candles, the sensor(s) ensure that the flammable gas exiting the assembly is burning. When a flame is not present, the sensor(s) and control circuit cooperate to close a valve to prevent flammable gas from entering a room adjacent to the fireplace.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The modular multiple-mode gas-fueled assembly can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale; emphasis instead is placed upon clearly illustrating the principles of the modular multiple-mode gas-fueled assembly and methods for using embodiments of the same.

[0014] FIG. 1 is a front perspective view of an embodiment of a base grate of the multiple-mode gas-fueled assembly.

[0015] FIG. 2 is a front perspective view of an embodiment of a holder of the multiple-mode gas-fueled assembly.

[0016] FIG. 3 is a front perspective view of an alternative embodiment of a base grate of the multiple-mode gas-fueled assembly.

[0017] FIG. 4 is a front perspective view of an alternative embodiment of a holder of the multiple-mode gas-fueled assembly suited for use with imitation logs.

[0018] FIGs. 5A-5C are a set of views that include a front perspective view and two cross-sectional views that illustrate an embodiment of imitation logs that can be arranged with the holder of FIG. 4.

[0019] FIG. 6 is a front perspective view of an alternative embodiment of a holder of the multiple-mode gas-fueled assembly suited for use with imitation candles.

[0020] FIG. 7 is a top plan view of an embodiment of a holder of the multiple-mode gas-fueled assembly suited for use with imitation candles.

[0021] FIGs. 8A and 8B are a top plan view and a front perspective view illustrating an embodiment of a support plate arranged with a respective upright column of the holder of FIGs. 2 and 7.

[0022] FIGs. 9A-9E is a set of perspective and plan views illustrating various embodiments of a holder of the multiple-mode gas-fueled assembly suited for use with imitation candles.

[0023] FIG. 10 is a schematic diagram illustrating an embodiment of a control circuit integrated with the various holders of the multiple-mode gas-fueled assembly.

[0024] FIG. 11 is a cross-sectional view of an embodiment of a holder of the multiple-mode gas-fueled assembly suited for use with imitation candles.

[0025] FIG. 12 is a flow diagram illustrating an embodiment of a method for associating a gas-fueled flame with an imitation fuel.

[0026] FIG. 13 is a flow diagram illustrating an alternative embodiment of a method for associating a gas-fueled flame with an imitation fuel.

[0027] FIG. 14 is a schematic diagram illustrating an alternative embodiment of a control circuit that can be integrated with the various holders of the multiple-mode gas-fueled assembly.

## DETAILED DESCRIPTION

[0028] Various aspects of the modular multiple-mode gas-fueled assembly, having been summarized above, reference will now be made in detail to the description of the representative assembly illustrated in the drawings. While the modular multiple-mode gas-fueled assembly will be described in connection with these drawings, there is no intent to limit the modular multiple-mode gas-fueled assembly to the embodiment or embodiments disclosed therein.

[0029] FIG. 1 is a front perspective view of an embodiment of a base grate 100 of the multiple-mode gas-fueled assembly. As illustrated, base grate 100 includes a front frame member 110 and a rear frame member 112 with a plurality of cradle members 115 coupled between front frame member 110 and rear frame member 112. Each of the cradle members 115 adjacent to an end of the base grate 100 are coupled to elevation members 113 arranged to contact the floor of a fireplace. As further illustrated in FIG. 1, cradle members 115 adjacent to an end of base grate 100 are configured with a plurality of receiving depressions 150. In accordance with standard practice, base grate 100 is made from a heat and fire resistant material or materials suitable for withstanding continued exposure to wood-fueled and gas-fueled fires.

[0030] In alternative embodiments (not shown), receiving depressions 150 are located along the upper surface of additional cradle members 115. In some other embodiments (not shown), cradle members 115 are not configured with receiving depressions 150. Preferred embodiments of base grate 100 include ornamental scrollwork attached to front frame member 110, rear frame member 112, and/or between adjacent cradle members 115. Such ornamental scrollwork is not illustrated in the embodiment of FIG. 1 for simplicity of illustration.

[0031] FIG. 2 is a front perspective view of an embodiment of a holder 200 of the multiple-mode gas-fueled assembly. As illustrated in FIG. 2, holder 200 includes a hollow distribution frame 210 including a front member 212, a rear member 214, and a plurality of U-shaped members 222. Each of the U-shaped members 222 has two upright columns 224. Hollow distribution frame 210 has an inlet port 220 coupled to a gas supply (not shown) via coupler 240 and a plurality of outlet ports 225 at the ends of the upright columns 224. Each of the U-shaped members 222 are hollow and are coupled to the front member 212 and the rear member 214 such that gas flowing into the

hollow distribution frame 210 at inlet port 220 fills the interior volume of the hollow distribution frame 210 and exits at each of the outlet ports 225.

[0032] The inner diameter of the hollow distribution frame 210 is reduced at or before each of the outlet ports 225 to reduce the outflow of gas at each of the outlet ports 225. Each of the outlet ports 225 is configured to simulate a wick of a candle. Consequently, the rate of gas outflow is controlled by the gas supply and the structure of the hollow distribution frame 210 to simulate a candle flame when the exiting gas is burning. As will be explained below, a solenoid actuated gas-supply valve is opened to enable the flow of gas from a supply through the hollow distribution frame 210 of holder 200 to supply each of the "candles" when it is desired to ignite and burn a gas-fueled imitation candle flame at each of the plurality of outlet ports 225.

[0033] As further illustrated in FIG. 2, a plurality of support plates 228 closely surround the exterior surface of upright columns 224. For simplicity of illustration, the illustrated embodiment shows two support plates associated with corresponding upright columns 224. It should be understood that in embodiments directed to imitation candles (as explained in further detail below) each upright column 224 is arranged with a respective support plate 228. In some embodiments, support plates 228 are arranged with a hole having a diameter selected to engage the outer surface of the respective upright column 224 at a desired height along the length of the upright column 224. In other embodiments, a sleeve or a plurality of appendages (not shown) are fixed to the outer surface of the upright column 224 such that the upper surface of the sleeve (or the appendages) contacts the lower surface of the support plate 228 at the desired height along the length of the upright column 224. Each of the support plates 228 is configured to support an imitation candle (not illustrated in FIG. 2 for simplicity of illustration).

[0034] Holder 200 is made of either hollow steel, aluminum, copper, or other materials. In the embodiment illustrated in FIG. 2, both the front member 212 and the rear member 214 are provided with a plurality of appendages 252 for stabilizing the holder 200 when it is placed on the base grate 100 illustrated in FIG. 1. As indicated by the dashed lines associating holder200 with base grate 100, appendages 252 are received in a corresponding receiving depression 150 of the base grate 100.

[0035] When the holder 200 of FIG. 2 is placed above base grate 100 of FIG. 1, a first embodiment of the modular multiple-mode gas-fueled assembly is formed.

[0036] FIG. 3 is a front perspective view of an alternative embodiment of a base grate 300 of the multiple-mode gas-fueled assembly. Base grate 300 includes a front frame member 310 and a rear frame member 312 with a plurality of cradle members 315 coupled to each of the front and rear frame members 310, 312. Each of the cradle members 315 adjacent to an end of the base grate 300 are coupled to elevation members 313 arranged to contact the floor of a fireplace. Base grate 300 is constructed similarly to base grate 100 in that it is made from a heat and fire resistant material or materials suitable for withstanding continued exposure to wood fueled fires.

[0037] FIG. 4 is a front perspective view of an alternative embodiment of a holder 400 of the multiple-mode gas-fueled assembly suited for use with imitation logs. Holder 400 includes a hollow distribution frame 410 including a front member 412, a rear member 414, and a plurality of U-shaped members 422. Each of the U-shaped members 422 has two upright columns 424. Hollow distribution frame 410 has an inlet port 420 coupled to a gas supply (not shown) via coupler 440 and a plurality of outlet ports 425 at the ends of the upright columns 424. Each of the U-shaped members 422 are hollow and are coupled to the front member 412 and the rear member 414 such that gas flowing into the hollow distribution frame 410 at inlet port 420 fills the interior volume of the hollow distribution frame 410 and exits at each of the outlet ports 425.

[0038] In the embodiment illustrated in FIG. 4, front member 412 and rear member 414 are further attached by solid support members 415 at each end of the holder 400. Solid support members 415 are not part of the gas distribution network within hollow distribution frame 410. Solid support members 415 are made from materials suitable for withstanding continued exposure to gas-fueled fires.

[0039] Compression fastener 445 is arranged to couple holder 400 to cradle members 315 at the ends of base grate 300 (FIG. 3). A single example of a compression fastener 445 is visible in the embodiment illustrated in FIG. 4. View A-A reveals a cross-sectional view of the compression fastener 445 in position over support member 415 and cradle member 315. Compression fastener 445 substantially surrounds solid support member 415 and a lesser portion of the outer surface of cradle member 315. The arrangement illustrated in view A-A reveals the relative position of cradle member 315 (FIG. 3) and solid support member 415.

[0040] Holder 400 is made of either hollow steel, aluminum, copper, or other materials. When holder 400 is combined with base grate 300 (FIG. 3) to form a second embodiment of the modular multiple-mode gas-fueled assembly.

[0041] In alternative embodiments (not shown), holder 400 can be arranged to rest upon base grate 300 without compression fastener(s) 445. In another alternative embodiment, support members 415 are hollow tubes. While support members 415 are hollow tubes (in the alternative embodiment) there is no intent for the support members 415 to integrate with the gas circuit formed in the interior volume of the hollow distribution frame 410.

[0042] FIG. 5 is a front perspective view and two cross-sectional views that illustrate an embodiment of imitation logs 500 that can be arranged with the holder 400 of FIG. 4. In the embodiment illustrated in FIG. 5, imitation logs 500 are arranged in a relatively orderly fashion with each individual log relatively parallel to its neighbors. Other arrangements are possible and contemplated. The imitation logs 500 are manufactured from concrete, ceramic, and/or other materials that will not burn when placed in close proximity with a gas-fueled flame.

[0043] View A-A reveals that imitation logs 500 form a void 510 that can completely surround holder 400 (FIG. 4). View B-B further illustrates that over portions of the length of imitation logs 500, apertures 515 are provided to allow flames fueled from respective outlet ports 425 of holder 400 (FIG. 4) to appear from between the individual logs to simulate a wood-burning fire. Apertures 515 are arranged to substantially align with respective upright columns 424 of holder 400 (not shown). As in view A-A, void 510 as illustrated in view B-B surrounds holder 400.

[0044] FIG. 6 is a front perspective view of an alternative embodiment of a holder 600 of the multiple-mode gas-fueled assembly suited for use with imitation candles 612. As shown in FIG. 6, holder 600 includes a hollow distribution frame 610 suitable for placement on the floor of a fireplace.

[0045] Hollow distribution frame 610 forms a contiguous circuit that is coupled to inlet port 620. Inlet port 620 is coupled to a gas supply 650 via coupler 640. Hollow distribution frame 610 further includes a plurality of hollow upright columns 624 coupled to the contiguous circuit such that gas flowing into the hollow distribution frame 610 at inlet port 620 fills the interior volume of the hollow distribution frame 610 and exits at each of the outlet ports 625.

[0046] Each upright column 624 is arranged with a respective support plate 628, which supports an imitation candle 612. The imitation candles 612 surround that portion of the length of upright columns 624 above the respective support plate 628. As illustrated by the one displaced imitation candle 612 and view A-A, the inner diameter of each of the outlet ports 625 is smaller than the inner diameter at inlet port 620 as shown in view B-B. The smaller diameter of the outlet ports 625 allows each to simulate a wick extending from the top of the respective imitation candles 612.

[0047] Hollow distribution frame 610 is just one embodiment of many that can be used to supply gas to each of the outlet ports 625 of holder 600. For example, the hollow distribution frame 610 can be arranged in a "H" configuration. That is, two substantially parallel tubes interconnected by a single tube substantially perpendicular to the substantially parallel tubes. In a similar arrangement, the hollow distribution frame 610 can be shaped in the likeness of an "I," by using a substantially perpendicular tube that is relatively longer than the substantially parallel tubes. In some embodiments, hollow distribution frame 610 may be formed of a single tube supported by one or more appendages fixed to the outer surface of the tube and arranged to contact the floor of a fireplace. Other arrangements are limited only by the imagination of the designer and the footprint of the fireplace where the holder 600 is used.

[0048] Holder 600 is made of either hollow steel, aluminum, copper, or other materials. Holder 600 when coupled to a gas supply and arranged with support plates 628 and imitation candles 612 forms a third embodiment of the modular multiple-mode gas-fueled assembly.

[0049] FIG. 7 is a top plan view of an embodiment of a holder 700. Holder 700 is coupled to gas supply 705 via a number of elements coupled in series between the gas supply 705 and the plurality of outlet ports 725 of hollow distribution frame 710. As illustrated, gas supply 705 enters gas valve 730, which is controllably opened and closed by solenoid 734. Solenoid 734 is electrically coupled to control circuit 732.

[0050] Gas valve 730 is connected via a first coupler 735 associated with a first quick connect/disconnect connector 737, a supply line 738, a second quick connect/disconnect connector 740, and a second coupler 740 to regulator 745. Regulator 745 is coupled to inlet port 720 of hollow distribution frame 710.

[0051] In the illustrated embodiment, supply line 738 is a solid tube. In alternative embodiments (not shown), supply line 738 is flexible and when connected to

couplers 735, 740 provides a mechanism for quickly connecting and disconnecting various hollow distribution frames associated with the various embodiments of the multiple-mode gas-fueled assembly. When the quick connect/disconnect connectors 737, 740 are not engaged, the flow of flammable gas from a proximal reservoir or a commercial supplier is terminated at the respective coupler 735, 742.

[0052] Regulator 745 provides an operator adjustable mechanism for controllably altering the height of a flame burning in close proximity to each of the respective outlet ports 725. Thus, regulator 745 enables an operator to controllably adjust the height of the flame burning at an imitation candle introduced over each of the upright columns 724. Note that regulator 745 and the other elements coupled in series between gas supply 710 and the hollow distribution frame 710 can be arranged with previously introduced holders. For example, when coupled to holder 400, regulator 745 can be used to controllably adjust the height of the flames burning above each respective outlet port 425, thus enabling an operator to simulate a wood-burning fire.

[0053] As in the other embodiments, holder 700 is configured with a plurality of upright columns 724 (nine shown) each with a respective outlet port 725. In the present embodiment, as shown in the detail of FIG. 7, each of the outlet ports 725 is provided with a gas distribution plate 760. The gas distribution plate 760 includes a plurality of openings 762 that enable the gas to escape from the respective outlet port 725. Gas distribution plate 760 and openings 762 ensure that escaping gas exiting from the corresponding outlet port 725 mixes with ambient air producing an even flame. In some embodiments, gas distribution plate can be coated with a material that in the presence of a flammable gas causes the flame to burn with a color similar to that of wax candles.

[0054] FIGs. 8A and 8B are a top plan view and a front perspective view illustrating an embodiment of a support plate 828 arranged with a respective upright column 824. In the embodiment illustrated in FIG. 8A, support plate 828 is substantially circular with a substantially circular concentric hole 838 for receiving the respective upright column 824. When support plate 828 is set over an upright column 824 having a tapered outer diameter, as illustrated in FIG. 8B, the support plate 828 engages the outer surface 856 of the upright column 824 along the length of the upright column 824 where the diameter of the concentric hole 838 (FIG. 8A) matches the outer diameter of the upright column 824.

[0055] FIGs. 9A-9E are a set of perspective and plan views illustrating various embodiments of a holder of the multiple-mode gas-fueled assembly suited for use with imitation candles. As illustrated in FIG. 9A, upright column 924a extends upward from hollow distribution frame 910. Support plate 928a engages the outer surface of upright column 924a as described above. Imitation candle 912a rests on support plate 928a and encompasses a significant portion of the upright column extending above the upper surface of support plate 928a.

[0056] As further illustrated in FIG. 9A, a fuel distribution plate 960 is disposed in close proximity to outlet port 925 in upright column 924a. Fuel distribution plate 960 is described in further detail in association with FIG. 9C.

[0057] In FIG. 9B, upright column 924b extends upward from hollow distribution frame 910. Support plate 928b engages the outer surface of upright column 924b as described above. Imitation candle 912b rests on support plate 928b and encompasses a significant portion of the upright column extending above the upper surface of support plate 928b. FIGs. 9A and 9B together illustrate the versatility of multiple-mode gas-fueled assembly to readily accept various configurations of imitation candles 912a, 912b and support plates 928a, 928b.

[0058] Imitation candles 912a, 912b can be constructed of ceramic, resin, wax, cement, concrete, and/or other materials. Imitation candles 912a, 912b can vary in style, size, color, etc. Imitation candles 912a, 912b have an inner diameter greater than the largest outer diameter of the upright column 924a, 924b, 924c, 924e providing gas to each respective outlet port 925. The inner diameter can vary over the length (i.e., the height) of the imitation candles 912a, 912b such that a chamber that is form fitting to the exterior surface of the upright column 924a, 924b is formed. Imitation candles 912a, 912b rest on a respective support plate 928a, 928b configured to support the imitation candles. In alternative embodiments, the imitation candles may be fixed to the respective support plates 928a, 928b.

[0059] FIG. 9C illustrates an alternative embodiment of an upright column. Upright column 924c is flared. Fuel distribution plate 960 is attached or otherwise rests within the bowl formed by the flared end of upright column 924c. Fuel distribution plate includes a plurality of openings 962 for separating and spreading the flammable gas exiting the upright column 924c to produce a wider and more distributed flame. The resulting flame produced from a plurality of similarly configured outlet ports 925 may be

used in connection with each of the holders presented herein. Larger, and similarly arranged structures can be added to holder 400 to simulate a wood-burning fire.

[0060] The alternative embodiment illustrated in FIG. 9C further includes a flame distributor 920. Flame distributor 920 is attached to the upper surface of fuel distribution plate 960. Flame distributor 920 includes a base 922 and a wick simulator 924. Wick simulator, as shown in FIG. 9C extends upward from base 922 such that it enters that space above the fuel distribution plate 960 where a flame is expected to burn. Flame distributor 920 causes the gas-fueled flame to spread and flicker to simulate a candle flame. Wick simulator 922 can be anodized or otherwise coated with a black material that will not discolor in the presence of a gas-fueled flame.

[0061] FIG. 9D is a front plan view of the alternative embodiment of FIG. 9C with a flame 950 present above upright column 924c. The base 922 of flame distributor 920 is shown in relation to outlet port 925 of upright column 924c. As described above, the distal end of wick simulator 922 is disposed within flame 950 and causes flame 950 to flicker over time.

[0062] FIG. 9E is a front plan view of an alternative embodiment of upright column. As shown in FIG. 9E, the outer and inner diameters of upright column 9E change abruptly at a location above distribution frame 910. The abrupt reduction in the diameter of upright column 924e forms a ledge 970 suitable for supporting an appropriately sized support plate 928a, 928b (FIGs. 9A, 9B). That portion of upright column 924e having the reduced diameter can be anodized or otherwise colored black to simulate a wick.

[0063] FIG. 10 is a schematic diagram illustrating an embodiment of a control circuit 732 that can be integrated with the various holders of the multiple-mode gas-fueled assembly. Control circuit 732 is powered by direct-coupled power supply 1002. Power supply 1002 can be a single rechargeable battery, a plurality of rechargeable batteries, or a plurality of single use batteries.

[0064] The positive terminal of power supply 1002 is coupled to on/off switch 1004, which supplies energy via series-coupled power resistors 1006 and 1008 to junction 1009. Junction 1009 is coupled via resistor 1012 and connector 1013 to a plurality of series connected sensors 1015. The series connected sensors 1015 are coupled via conductor 1017 and second connector 1013 and diode 1014 to the base, B, of power transistor 1020. Junction 1009 is also coupled to the collector, C, of power transistor 1020. When power transistor 1020 is turned on, solenoid 734,

coupled to the emitter, E, of power transistor 1020, is energized. When solenoid 734 is energized, valve 730 is opened. When power transistor 1020 is off, solenoid 734 is not energized and valve 730 is closed, thus preventing the flow of gas into the inlet port of the hollow distribution frame of the various embodiments of the multiple mode gas-fueled assembly. Solenoid 734 is further coupled to electrical ground.

[0065] Junction 1009 is also coupled to an override-to-light switch 1010, which when closed is coupled to electrical ground via resistor 1016 and capacitor 1018. When override-to-light switch 1010 is closed, power transistor 1020 remains on regardless of the condition of the series-coupled sensors 1015. Consequently, when the override-to-light switch 1010 is closed, valve 730 is opened by solenoid 734. When the override-to-light switch 1010 is open, each of the series connected sensors ensures that a flame is present in close proximity to a respective outlet port of the hollow distribution frame to ensure gas is not escaping into a room adjacent to the gas-fueled assembly. When one of the series coupled sensors 1015 detects that a flame is not present, power transistor 1020 is turned off, thus closing valve 730.

[0066] FIG. 11 is a cross-sectional view of an embodiment of a support plate 1128 and an imitation candle 1112 illustrating the arrangement of a sensor mount 1150 in close proximity with an outlet port 1125. In the embodiment illustrated in FIG. 11, hollow distribution frame 1110 provides flammable gas to the internal volume of upright column 1124. A substantially horizontal outer surface of upright column 1124 provides a ledge for support plate 1128 to rest. The substantially horizontal outer surface of upright column 1124 marks that point along the length of upright column 1124 where the inner diameter, D, is substantially reduced. That portion of the upright column 1124 extending upwards from support plate 1128 is arranged to simulate a wick of a candle. Imitation candle 1112 rests on support plate 1128. Outlet port 1125 is proximal to the top of the imitation candle 1112.

[0067] Sensor mount 1150 is attached to the upper surface of support plate 1128. As illustrated in FIG. 11, sensor mount 1150 is arranged such that a sensor disposed therein will be able to detect the presence (or lack thereof) of a flame burning in proximity to outlet port 1125. Each respective sensor associated with a gas-fueled assembly is coupled via conductor 1117 in series with the remaining sensors. The series connected sensors are coupled to control circuit 732 (FIG. 10). Sensors suited for detecting the presence of a flame include photosensitive transistors and diodes. The photosensitive

sensors can include sensors designed to detect the presence of specific ranges of electromagnetic energy.

[0068] In alternative embodiments, (not shown) thermistors can replace photosensitive sensors to detect the presence of a flame burning in proximity to a respective outlet port by sensing the heat generated by the flame. Those skilled in the art will understand that the arrangement of control circuit 732 will vary when thermistors are used to detect the presence of a flame.

[0069] FIG. 12 is a flow diagram illustrating an embodiment of a method for associating a gas-fueled flame with an imitation fuel. Method 1200 begins with block 1202 where a support structure is provided for a gas-fueled holder having an inlet port and a plurality of outlet ports. In block 1204, the gas-fueled holder is mounted to the support structure. In block 1206, the gas-fueled holder is coupled to a flammable gas supply. In block 1208, the flammable gas is provided at an inlet port of the gas-fueled holder. In block 1210, an ignition means is introduced at an outlet of the gas-fueled holder. In block 1212, each of the outlet ports of the gas-fueled holder are substantially surrounded with a representation of a fuel.

[0070] FIG. 13 is a flow diagram illustrating an alternative embodiment of a method 1300 for associating a gas-fueled flame with an imitation fuel. Method 1300 begins with block 1302 where a gas-fueled holder is provided. The gas-fueled holder has an inlet port and a plurality of outlet ports. In block 1304, the gas-fueled holder is coupled to a gas supply. In block 1306, a flammable gas is provided at the inlet port. In block 1308, each of the outlet ports of the gas-fueled holder is substantially surrounded with a representation of a fuel. In block 1310, an ignition means is introduced at an outlet of the gas-fueled holder.

[0071] FIG. 14 is a schematic diagram illustrating an alternative embodiment of a control circuit 1432 that can be integrated with the various holders of the multiple-mode gas-fueled assembly. Control circuit 1432 is powered by a plurality of thermocouples 1418 with control being directed by a plurality of photo-sensitive transistor 1415.

[0072] The collector, C, of power transistor 1420 is coupled to solenoid 734, which is mechanically coupled to gas valve 730. Solenoid 734 is further coupled via connectors 1417 to a plurality of thermocouples 1418. The thermocouples 1418 are coupled in series between connectors 1417. When heat energy is present in proximity

to the thermocouples 1418, a voltage, V, is produced between solenoid 734 and the emitter, E, of power transistor 1420.

[0073] Collector, C, of power transistor 1420 is further coupled to base, B, of the power transistor 1420 via resistor 1414, connectors 1413, and a plurality of photo-sensitive transistors 1415. When light energy is incident upon the photo-sensitive transistors 1415, power transistor 1420 is turned on. When light energy is not incident upon the photo-sensitive transistors 1415, power transistor 1420 is turned off. When power transistor 1420 is turned on, solenoid 734 is energized. When solenoid 734 is energized, valve 730 is opened. When power transistor 1420 is off, solenoid 734 is not energized and valve 730 is closed, thus preventing the flow of gas into the inlet port of the hollow distribution frame of the various embodiments of the multiple mode gas-fueled assembly.

[0074] Gas valve 730 is configured with a mechanism that enables an operator of the gas valve 730 to override the control provided by solenoid 734. When an operator of the multiple-mode gas-fueled assembly wants to light a flame at the outlet ports of the holder, the operator opens gas valve 730 and provides an ignition source at one or more of the outlet ports. Once the flammable gas is burning, both heat and light energy are converted by the thermocouples 1418 and the photo-sensitive transistors 1415, respectively such that control circuit 1432 keeps solenoid 734 energized and gas valve 730 open. When the flammable gas is not burning, the absence of heat and light energy proximal to the thermocouples 1418 and the photo-sensitive transistors 1415 causes control circuit 1432 to de-energize solenoid 734, thus closing gas valve 730.

[0075] It should be emphasized that the above-described embodiments are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the modular multiple-mode gas-fueled assembly. Many variations and modifications may be made to the above-described embodiment(s) of the modular multiple-mode gas-fueled assembly without departing substantially from the principles thereof. All such modifications and variations, including methods for associating an imitation fuel with a gas-fueled flame, are intended to be included herein, are within the scope of this disclosure, and protected by the following claims.